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Abstract

We study the evolution of interest about climate change between different actors of the population, and how the interest of those actors affect one another. We first document the evolution individually, and then provide a model of cross influences between them, that we then estimate with a VAR. We find large swings over time of said interest for the general public by creating a Climate Change Index for Europe and the US (CCI) using news media mentions, and little interest among economists (measured by publications in top journals of the discipline). The general interest science journals and policymakers have a more steady interest, although policymakers get interested much later.

JEL-Codes: Q540, Q580, D850, A130.

Keywords: climate change, social norms, text analysis, social networks.

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1 Introduction

"The furnaces of the world are now burning about 2,000,000,000 tons of coal a year. When this is burned, uniting with oxygen, it adds about 7,000,000,000 tons of carbon dioxide to the atmosphere yearly. This tends to make the air a more effective blanket for the earth and to raise its temperature. The effect may be considerable in a few centuries.". August 14, 1912, Rodney & Otamatea Times "Science Notes and News".

As the quote above shows, the knowledge about anthropogenic climate change is not exactly new. Nor is the knowledge that it can create problems for humanity. Huntington (1917) in the *Quarterly Journal of Economics* already claimed that climate change (not necessarily anthropogenic in this case) partially explained the fall of Rome.

Tackling this problem requires that regulators of different sorts take decisions that provide incentives for abatement. But as the references above show they are being very slow in doing this. The science about climate change has been there for a long time. So why does it seem that action is not happening sufficiently quickly?

A first answer is that there is already some action. Many regulators are aware of the problem. The European Commission has a Technical Expert Group on sustainable finance (TEG) which has produced several reports, for example, an EU taxonomy – to determine whether an economic activity is environmentally sustainable; an EU Green Bond Standard; methodologies for EU climate benchmarks and disclosures for benchmarks; and guidance to improve corporate disclosure of climate-related information. All of this suggests that perhaps in the future we will have a stronger reaction by regulators to climate change. But there is still the question why has this not happened much earlier and how long will it take until there are significant effects.

Our hypothesis is that the evolution of social norms is a slow process, and their transmission between different social groups is also complicated. We start from a situation in which, as Carney (2015) pointed out "The horizon for monetary policy extends out to 2-3 years. For financial stability it is a bit

longer, but typically only to the outer boundaries of the credit cycle – about a decade." If that is the status quo (social norm) about appropriate actions by central banks, it is difficult to expect the regulators to start taking a view that goes perhaps to half a century or more.

But even if norms are slow in changing, they do change. A recent study shows that women are now seen as equal or more competent than men, something that didn't happen half a century ago. A similar thing happens with same-sex marriage. These changes in attitudes are now encoded in regulations fostering gender equality in corporate boards, or laws allowing same-gender marriage. But it gets even better. For environmental protection both farmers, and businesses in general, often go beyond legal mandates. And as Gunningham et al. (2004) say: "the increasing incidence of "beyond compliance" corporate behavior can be better explained in terms of the interplay between social pressures and economic constraints."

Our project approach to answering the question for how norms change and diffuse between groups starts by proposing a model of norms transmission in social networks. We assume that individuals take actions that have an (idiosyncratic) benefit and a cost. In addition, there is a complementarity between the actions of the individual and those of others in her group and in other groups that are "close" to them or whose opinions are important. The model has a simple linear quadratic structure (as in Ballester et al. (2006)) and delivers a unique equilibrium where the actions of group members depend on their idiosyncratic preferences and those of others in close groups. Given its structure, the model's parameters can be easily identified through an econometric model.

We complement the analytical framework for the problem with its empirical analysis. The aim of this part of the project is to ascertain the web of influences between different actors in climate change policy. We have collected information (using advanced web-scraping methods) about mentions to climate change in mainstream news media (from the US, UK, Germany, France, and Spain), general interest scientific journals (Nature, Science), top Economics journals,[1] European Parliament questions, and European Cen-

[1]The so-called top 5: *Quarterly Journal of Economics*, *American Economic Review*,

tral Bank presidential speeches, since the 1990s. We then build a Vector Auto Regressive model (VAR) to estimate how the mentions in one of these actors in one period are correlated with lagged mentions by other actors.

In terms of descriptive evidence, we have found that natural scientists had been concerned with the problem since more than 30 years ago, academic economists are generally unconcerned even now, the mainstream media and the European Parliament started worrying seriously about the problem about the turn of the century, and the ECB increased their concern in very recent years.

In terms of the analytical results from the VAR, we study the data at quarterly frequency. Three of our variables are mentions about climate change in different outlets: the news media, Euro parliament, and general interest scientific journals. We also use GDP as a control variable. We find that media and the parliament are mutually affected. Other than that, we also find strong interactions with GDP fluctuations. This is a concern. A long term problem like climate change should not ebb and flow with relatively small (in the grand scheme of things) output fluctuations. But the finding can be a tool for concerned organizations to focus the resources at times of social inattention.

We cannot find influences of science on media or parliament. It is tempting to think scientific efforts are useless in this domain, particularly given the slow motion of regulatory responses. But we need to be cautious, it could also be that the influences are more subtle than the statistical model can capture.

1.1 Related literature

This paper contribute to several strands of the literature. One of them is the one related to social norms. Fehr and Schurtenberger (2018) have argued that many regularities regarding cooperation can be explained if individuals hold a social norm of conditional cooperation (Kimbrough and Vostroknutov (2016) and Kölle et al. (2020), Szekely et al. (2021) provide

Journal of Political Economy, *Econometrica* and *Review of Economic Studies*.

evidence of norm-following that leads to cooperation). In fact, social norms have been proposed as a key instrument to solve social dilemmas (Ostrom (2000); Bicchieri (2005); Biel and Thøgersen (2007)) in general, and climate change in particular Riehm et al. (2020). We contribute to this literature by providing a model and evidence showing how those norms spread in the population.

We also contribute to a large literature about the media communication of climate change (Wilson (2013), Gavin (2009)). To this literature we provide a comprehensive view of the evolution of the coverage and its interaction with other domains. A similar contribution is provided to the literature on scientific journals coverage of climate change (including the surprisingly low coverage in top economics journals) as in Nielsen and Schmidt Kjærgaard (2011), Ladle et al. (2005), Oswald and Stern (2019), or in political circles Willis (2017), Willis (2018), and central banks Olovsson (2018), Skinner (2021).

Our method for creating indices is taken from Baker et al. (2016) and Ghirelli et al. (2021) applied to a different field. Our theoretical model is inspired by the work in social networks pioneered by Ballester et al. (2006)

2 Evolution of mentions to climate change

In this section we provide a visual description of the evolution of climate change mentions in different sectors: the news media, the Euro parliament, scientific journals, and ECB speeches. This is our proxy for the preoccupation about climate change in those sectors.

2.1 Developing a Climate Change Index of Public Interest

We analyze the presence of Climate Change and their evolution over time for the main American and European newspapers. Baker et al. (2016) manages to measure an unobservable variable, such as uncertainty in Economic Policy, with an idea as simple as it is powerful: the level of impact that this variable has is reflected in the repetition of terms related to economic uncertainty in the different newspapers over time. The more these terms are used, the

more impact/interest the variable is having in that period. In a similar way, we develop a Climate Change Index (CCI) using the universe of news in top European and United States newspapers using the keywords "climate change". It is trivial to observe, due to the nature of these words, that any text that uses them will be alluding to this problem, making identification very simple.

Following Baker et al. (2016), we standardize the monthly shares newspaper-level series to unit standard deviation from 1995 to 2021 and then average across the 12 European papers by month. Finally, we divide this average by the mean and multiply by 100 for the same period to obtain the normalized series.

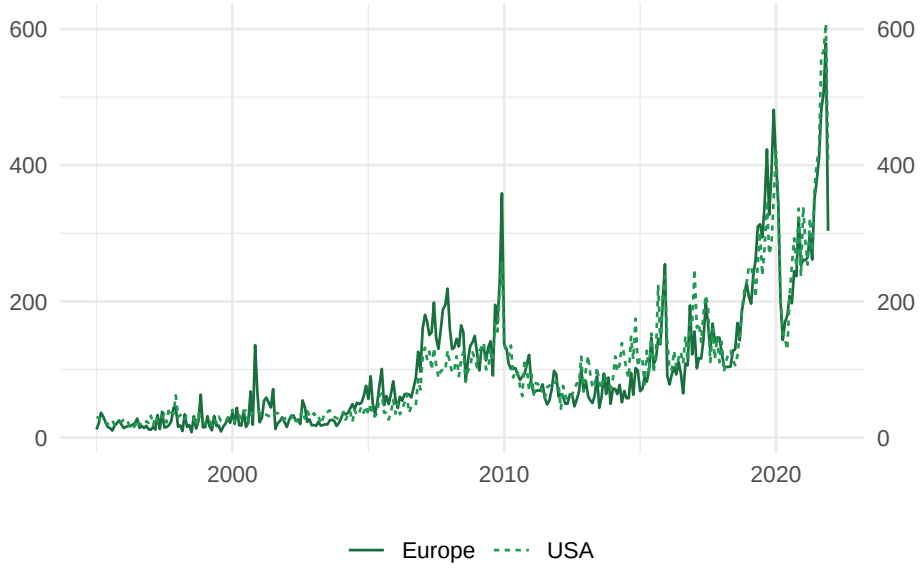

Figure 1: Monthly Climate Change Index for Europe and the USA

Figure 1 shows the Climate Change Index for Europe and the US, which have a correlation of 0.947. As we can see media does not show interest until around 2003, but it is not until 2015 that it becomes part of the relevant topics. It is interesting to notice how the media seems to respond to trends; there are peaks in which it pays attention to climate change, and other

periods in which the intensity drops even though the problem has not been solved, but on the contrary seems that the problem has become worse.

In the appendix we include the shares that climate change news occupy for the different newspapers that make up the index, in addition to an index for each country.

2.2 Climate Change and Top 5 journals in Economics

We count the number of papers published in Top 5 journals in Economics that use "Global Warming" or "Climate Change" in their abstract for the period 1999-2021. The results speak for themselves about economists' interest in the topic. Since the data is about published papers, it is difficult to know to which extent referees and editors are responsible for this, as we do not have data on submissions. It could be that climate change related papers have a higher proportion relative to total submissions.

Table 1: Count of words in the Top-5 Journals in Economics

	99	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21
Climate Change	0	0	0	0	0	0	0	0	1	0	0	0	1	2	0	1	2	2	0	0	1	1	0
Global Warming	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Systemic Risk	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	1	0	0
Environmental	2	3	3	0	0	4	1	3	1	2	2	1	2	7	2	2	2	3	1	4	3	4	5
Pollution	0	0	1	1	1	0	2	1	0	2	3	1	2	2	1	1	1	4	2	4	2	2	3
Carbon Tax	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	2	1	1	1	1	0
Optimal Taxation	0	0	1	0	0	0	0	1	2	1	1	2	0	0	0	0	0	3	0	0	2	2	0
Countercyclical	2	2	0	1	1	4	2	1	3	0	2	1	0	8	2	3	1	2	5	5	1	2	1
Gold Standard	0	0	1	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0
Corruption	1	1	0	2	2	0	2	1	3	1	1	0	1	0	1	2	3	2	0	2	0	2	2
Unemployment	3	2	5	2	4	7	5	5	8	7	6	9	7	5	7	6	7	11	13	12	6	9	7
Marketing	0	0	2	0	2	1	0	2	0	0	1	2	2	3	0	1	0	1	1	1	1	1	1
Monetary Policy	2	4	3	5	10	4	10	4	3	4	4	5	6	7	4	3	3	10	7	8	8	15	7
Game Theory	1	2	0	3	2	1	1	1	3	0	0	1	2	1	1	0	1	2	0	0	0	0	1
Optimal Policy	3	1	1	1	1	0	1	1	1	4	2	4	2	5	2	1	1	4	0	2	3	2	1
Inflation	1	6	8	7	12	3	12	7	7	7	9	2	10	3	3	2	5	4	7	8	12	6	7
Tax	9	4	7	9	10	4	13	10	5	11	13	8	9	11	21	11	16	20	19	14	28	16	21
Inequality	10	11	6	11	10	12	7	10	5	5	9	10	7	4	11	7	8	14	15	15	10	17	9
Transportation	0	0	1	0	0	2	1	0	1	1	2	0	2	1	0	0	0	1	0	2	2	1	0
Institutions	5	3	2	7	5	3	7	6	6	7	7	7	10	8	7	8	7	8	7	3	9	6	3
WWII	0	0	0	1	1	0	0	1	0	1	0	0	1	0	1	0	0	1	0	0	0	1	0

2.3 Climate Change and General Interest Scientific Journals

Following the methodology of the CCI for media, we construct an index using the main General Interest Scientific Journals, Nature and Science between 1995-2021. As we can see, interest in climate change is clearly growing with an stable trend over time, unlike what happens with the media, which seems to respond to behavioral criteria.

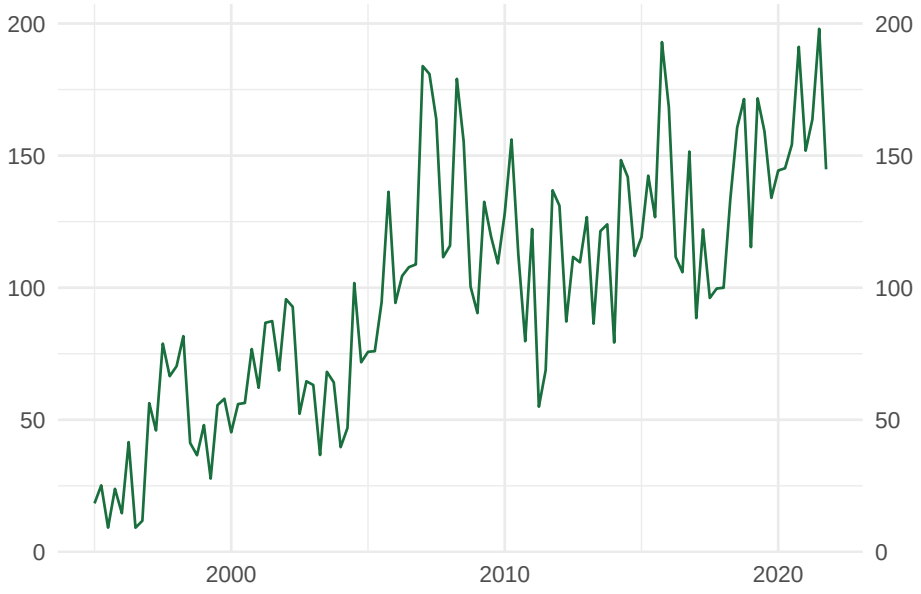

Figure 2: Quarterly Climate Change Index for the General Interest Science Journals.

2.4 European Parliament

We create a new source of information from the share of questions made in the European Parliament for the period 1995-2021 containing the words "climate change", normalized to have standard deviation and mean 100.

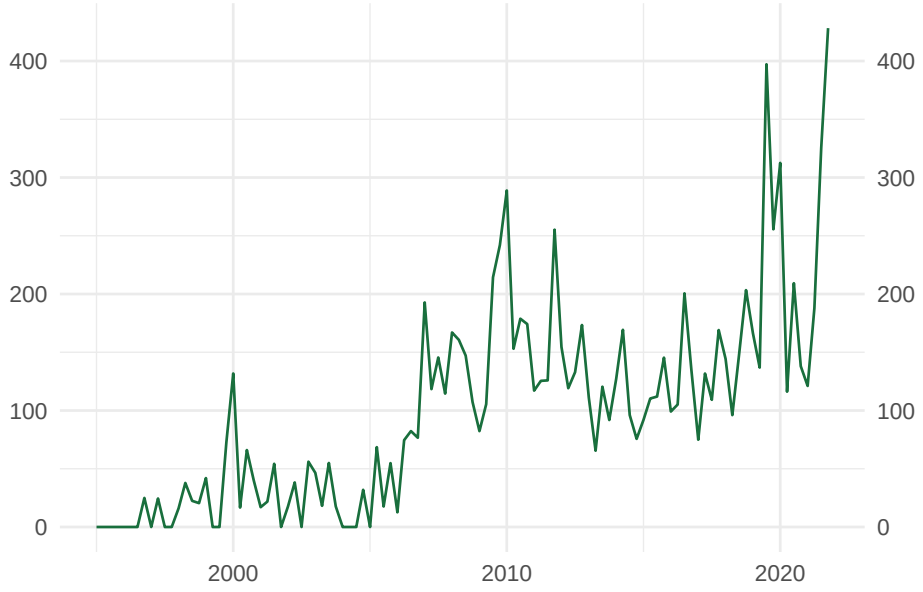

Figure 3: Quarterly Climate Change Index for the European Parliament

2.5 Central Bank Speeches

We count the share of ECB presidential speeches[2] in English mentioning the words "Climate Change" for the period since its creation in 1997, also, from the Central bankers' speeches available at the BIS repository[3].

Until 2018, these keywords were practically not used, demonstrating the lack of interest in the subject. However, since 2019, more than 50% of the ECB speeches and around a 25% of the total Central Bankers speeches

[2]Available at ECB site.

[3]The BIS site contains more then 17,000 speeches in English from the Federal Reserve, ECB, and many Central Banks.

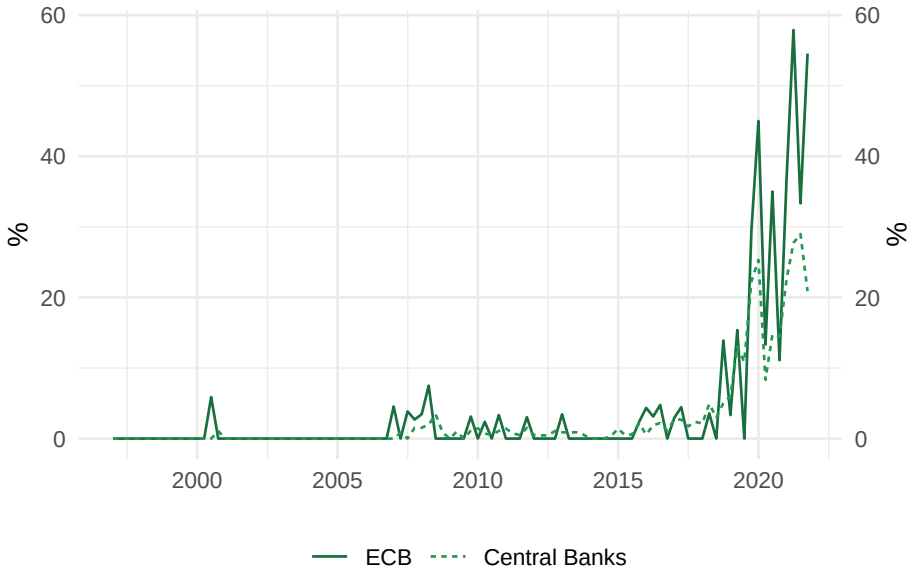

Figure 4: Share of Speeches containing the words "Climate Change"

already included these words, showing that although it cannot be analyzed in this paper due to the scarcity of data, climate change has become a crucial issue for the Central Banks.

In the Appendix we show the results of comparing mentions of climate change in ECB speeches with mentions of other relevant terms, like "taxes" or "inequality". Taxation is mentioned very frequently from the beginning, inequality is less frequent, but it starts earlier than climate change. Strikingly, climate change is now more frequently mentioned than either taxes or inequality.

2.6 The Federal Open Market Committee - FOMC

As a counterpoint to the ECB speeches we count the number of questions made in the transcripts from the FOMC for "Climate Change" for the period 1975-2015 (the transcripts are available only 5 years after). "Climate Change" appear only once (related to climate) here. Nevertheless, in the minutes published by the FOMC from 1993 to present, it only appear twice,

in 2019 and 2020.

3 A simple theoretical framework

In order to understand the relationship between the different institutions and social group whose preoccupation with climate we characterize with their public utterances, we first describe a tractable model which we later estimate using a vector auto-regression (VAR).

Every individual j belongs to some group G_j where $|G_j| \in R$. A parameter $\lambda_{G_iG_j}$ measures how a group i person cares about a group j person. Every individual experiences an idiosyncratic amount of intrinsic interest in the policy b_i. There is a costly action a_{i_t} that each individual takes in every period t. This action has a cost per unit c_i. With these elements in place, we can write the utility function as:

$$U_i\left(a_{i_t}, \mathbf{a}_{t-1}\right) = a_{i_t}\left(b_i + \sum_{j \in R} \lambda_{G_iG_j} a_{j_{t-1}}\right) - \frac{c_i}{2} a_{i_t}^2$$

Then, the optimal action for each individual can be written as:

$$a_{it} = \frac{1}{c_i}\left(b_i + \sum_{j \in R} \lambda_{G_iG_j} a_{j_{t-1}}\right)$$

And since the individual actions are linear in others' previous actions, we can aggregate to an institutional level (a key assumption in this case is that the interaction parameters $\lambda_{G_iG_j}$ are common within groups). Given this, the VAR constant in the equation for each group's "action" (the number of messages) is b_i/c_i, i.e. the intrinsic interest in the policy (relative to the cost of messaging) and a coefficient of the action of other groups is $\lambda_{G_iG_j}/c_i$ i.e. the impact on the marginal benefit of group G_i of an increase in G_j action (relative to the cost). We have introduced just one lag in this description but, of course, we can write as many as we want. Also we have written lagged actions in the utility function, but we can also write expectations and say that the expectations are formed naively so that

$$E\left(\mathbf{a}_t\right) = \mathbf{a}_{t-1}.$$

4 VAR model estimation

To understand the interconnection between the different actors we estimate a VAR micro-founded from the model in Section 3. It can be written as $X_t = \Pi(L)X_t + \epsilon_t$, where X_t is a set of endogenous variables, Π is a matrix of VAR coefficients capturing the dynamics of the system, and $\epsilon_t : N(0, \Sigma)$ is a vector of shocks having zero mean and variance–covariance matrix Σ. The variables in X_t are the following: x_1 is mentions of climate change in the media (CCI), x_2 is mentions in the European parliament questions (normalized), x_3 is mentions in science journals (CCI), and x_4 is GDP for the Euro Area (normalized).

Table 2 displays the results. The notation ARx(y,z) means that "x" is the lag, "y" the index of the variable whose effect we measure, and z is the index of the variable affected by it.

The data is quarterly, and at one quarter all variables are affected by their own lags. The Euro Parliament positively affects the media. This means that an increase in the debate in the European Parliament on climate change translates into an increase in the media interest in the following quarter.

At two quarters there are no own effects. We also find a negative effect of Euro Parliament on media, which can be interpreted as the loss of media interest on climate change after a quarter. There is also a reciprocal negative effect of media on Euro parliament.

At three quarters the only own effects are given by scientific journals and GDP. There is a negative effect of GDP in the Euro Parliament. Six months after a boom they forget about climate change, but they mention it more during a recession.

At four quarters the only own effect is given by GDP, and there is only one positive effect from GDP to the Euro parliament. This can be interpreted as the lack of persistence of the effect appeared at three quarters.

Generally speaking, we find that media is affected by the parliament, and parliament is affected by the media. Other than that, we also find very strong interactions with GDP fluctuations. This is worrying since attention

in a long term issue like climate change should not be driven by short time fluctuations in economic activity. But it is an important finding as it suggests a time when activists should concentrate their efforts. Science, on the other hand, seems to have no discernible effect on either parliament or the media. This is probably because the influences of Science are more subtle and long-term than the statistical model can uncover.

Table 2: VAR: ARx(y,z) "x" is the lag, "y" is affecting variable, and "z" is affected variable

	Value	Standard Error	TStatistic	PValue
Constant(1)	-101.51	56.43	-1.8	0.07
Constant(2)	-92.19	78.69	-1.17	0.24
Constant(3)	-93.88*	41.64	-2.25	0.02
Constant(4)	1.54	2.59	0.6	0.55
AR1(1,1)	0.82***	0.12	6.91	0
AR1(2,1)	0.61***	0.17	3.69	0
AR1(3,1)	0.01	0.09	0.15	0.88
AR1(4,1)	0	0.01	-0.39	0.7
AR1(1,2)	-0.07	0.08	-0.88	0.38
AR1(2,2)	0.24**	0.11	2.08	0.04
AR1(3,2)	0	0.06	0.01	0.99
AR1(4,2)	-0.01	0	-1.55	0.12
AR1(1,3)	0.06	0.14	0.42	0.68
AR1(2,3)	-0.17	0.19	-0.88	0.38
AR1(3,3)	0.39***	0.1	3.88	0
AR1(4,3)	0.01	0.01	1.48	0.14
AR1(1,4)	3.23	2.23	1.45	0.15
AR1(2,4)	0.3	3.11	0.1	0.92
AR1(3,4)	0.91	1.65	0.55	0.58
AR1(4,4)	0.79***	0.1	7.76	0
AR2(1,1)	0.23	0.15	1.57	0.12
AR2(2,1)	-0.44*	0.21	-2.1	0.04
AR2(3,1)	0.11	0.11	0.96	0.34
AR2(4,1)	0	0.01	-0.57	0.57
AR2(1,2)	-0.25	0.08	-2.97	0
AR2(2,2)	0.16	0.12	1.35	0.18
AR2(3,2)	-0.02	0.06	-0.38	0.71
AR2(4,2)	0	0	-0.38	0.71

Table 3: VAR: ARx(y,z) "x" is the lag, "y" is affecting variable, and "z" is affected variable

	Value	Standard Error	TStatistic	PValue
AR2(1,3)	0.2	0.14	1.43	0.15
AR2(2,3)	-0.1	0.2	-0.48	0.63
AR2(3,3)	-0.12	0.11	-1.12	0.26
AR2(4,3)	0.01	0.01	1.28	0.2
AR2(1,4)	-4.44	2.55	-1.74	0.08
AR2(2,4)	1.21	3.56	0.34	0.73
AR2(3,4)	-2.39	1.88	-1.27	0.2
AR2(4,4)	0.02	0.12	0.2	0.84
AR3(1,1)	-0.11	0.15	-0.72	0.47
AR3(2,1)	0.22	0.21	1.08	0.28
AR3(3,1)	-0.15	0.11	-1.32	0.19
AR3(4,1)	0	0.01	0.45	0.65
AR3(1,2)	-0.1	0.09	-1.21	0.23
AR3(2,2)	-0.07	0.12	-0.62	0.54
AR3(3,2)	0.01	0.06	0.15	0.88
AR3(4,2)	-0.02***	0	-4.2	0
AR3(1,3)	-0.14	0.14	-1	0.32
AR3(2,3)	0.26	0.2	1.3	0.19
AR3(3,3)	0.26*	0.11	2.46	0.01
AR3(4,3)	0	0.01	-0.39	0.7
AR3(1,4)	3.37	2.52	1.34	0.18
AR3(2,4)	3.45	3.51	0.98	0.33
AR3(3,4)	2.77	1.86	1.49	0.14
AR3(4,4)	0.38**	0.12	3.27	0
AR4(1,1)	0.12	0.13	0.97	0.33
AR4(2,1)	-0.04	0.18	-0.22	0.83
AR4(3,1)	0.09	0.1	0.94	0.35
AR4(4,1)	0	0.01	0.43	0.67

Table 4: VAR: ARx(y,z) "x" is the lag, "y" is affecting variable, and "z" is affected variable

	Value	Standard Error	TStatistic	PValue
AR4(1,2)	0.15	0.09	1.79	0.07
AR4(2,2)	0.13	0.12	1.06	0.29
AR4(3,2)	-0.04	0.06	-0.58	0.56
AR4(4,2)	0.02***	0	4.68	0
AR4(1,3)	0	0.14	-0.03	0.98
AR4(2,3)	0.06	0.2	0.28	0.78
AR4(3,3)	-0.04	0.1	-0.43	0.67
AR4(4,3)	-0.01	0.01	-0.87	0.39
AR4(1,4)	-1.03	2.17	-0.47	0.64
AR4(2,4)	-3.85	3.03	-1.27	0.2
AR4(3,4)	0.19	1.6	0.12	0.91
AR4(4,4)	-0.21*	0.1	-2.1	0.04

5 Conclusion

We have documented the evolution of mentions of climate change in different environments: policy, sciences, and the general public (proxied by news media). We have also postulated a model about how those different environments influence one another and then estimated the model's parameters. We find large fluctuations of interest and interesting cross influences. A particularly salient one is related to how GDP evolution affects the interest in climate change. These observations could be a useful tool for timing activists and other groups interested in influencing social debate.

Future research could expand our results by doing a more fine grained analysis of the connections inside the different groups, potentially using tools from social complex network analysis.

References

Baker, Scott R., Nicholas Bloom, and Steven J. Davis, "Measuring Economic Policy Uncertainty*," *The Quarterly Journal of Economics*, 07 2016, *131* (4), 1593–1636.

Ballester, Coralio, Antoni Calvó-Armengol, and Yves Zenou, "Who's who in networks. Wanted: The key player," *Econometrica*, 2006, *74* (5), 1403–1417.

Bicchieri, Cristina, *The grammar of society: The nature and dynamics of social norms*, Cambridge University Press, 2005.

Biel, Anders and John Thøgersen, "Activation of social norms in social dilemmas: A review of the evidence and reflections on the implications for environmental behaviour," *Journal of economic psychology*, 2007, *28* (1), 93–112.

Carney, Mark, "Breaking the tragedy of the horizon–climate change and financial stability," *Speech given at Lloyd's of London*, 2015, *29*, 220–230.

Fehr, Ernst and Ivo Schurtenberger, "Normative foundations of human cooperation," *Nature Human Behaviour*, 2018, *2* (7), 458–468.

Gavin, Neil T, "Addressing climate change: a media perspective," *Environmental Politics*, 2009, *18* (5), 765–780.

Ghirelli, Corinna, María Gil, Javier J Pérez, and Alberto Urtasun, "Measuring economic and economic policy uncertainty and their macroeconomic effects: the case of Spain," *Empirical Economics*, 2021, *60* (2), 869–892.

Gunningham, Neil, Robert A Kagan, and Dorothy Thornton, "Social license and environmental protection: why businesses go beyond compliance," *Law & Social Inquiry*, 2004, *29* (2), 307–341.

Huntington, Ellsworth, "Climatic change and agricultural exhaustion as elements in the fall of Rome," *The Quarterly Journal of Economics*, 1917, *31* (2), 173–208.

Kimbrough, Erik O and Alexander Vostroknutov, "Norms make preferences social," *Journal of the European Economic Association*, 2016, *14* (3), 608–638.

Kölle, Felix, Tom Lane, Daniele Nosenzo, and Chris Starmer, "Promoting voter registration: the effects of low-cost interventions on behaviour and norms," *Behavioural Public Policy*, 2020, *4* (1), 26–49.

Ladle, Richard J, Paul Jepson, and Robert J Whittaker, "Scientists and the media: the struggle for legitimacy in climate change and conservation science," *Interdisciplinary Science Reviews*, 2005, *30* (3), 231–240.

Nielsen, Kristian Hvidtfelt and Rikke Schmidt Kjærgaard, "News coverage of climate change in nature news and science now during 2007," *Environmental Communication*, 2011, *5* (1), 25–44.

Olovsson, Conny, "Is Climate Change Relevant for Central Banks?," *Sveriges Riksbank Economic Commentaries*, 2018, *13.*

Ostrom, Elinor, "Collective action and the evolution of social norms," *Journal of economic perspectives*, 2000, *14* (3), 137–158.

Oswald, Andrew and Nicholas Stern, "Why does the economics of climate change matter so much–and why has the engagement of economists been so weak?," *Royal Economic Society Newsletter*, 2019.

Riehm, Tobias, Nicolas Fugger, Philippe Gillen, Vitali Gretschko, and Peter Werner, "Social Norms and Market Behavior–Evidence From a Large Population Sample," *ZEW-Centre for European Economic Research Discussion Paper*, 2020, (21-017).

Skinner, Christina Parajon, "Central Banks and Climate Change," *Vand. L. Rev.*, 2021, *74*, 1301.

Szekely, Aron, Francesca Lipari, Alberto Antonioni, Mario Paolucci, Angel Sánchez, Luca Tummolini, and Giulia Andrighetto, "Evidence from a long-term experiment that collective risks change social norms and promote cooperation," *Nature communications*, 2021, *12* (1), 1–7.

Willis, Rebecca, "Taming the climate? Corpus analysis of politicians' speech on climate change," *Environmental Politics*, 2017, *26* (2), 212–231.

_ , "Constructing a 'representative claim'for action on climate change: evidence from interviews with politicians," *Political Studies*, 2018, *66* (4), 940–958.

Wilson, Kris M, "Communicating climate change through the media: Predictions, politics and perceptions of risk," in "Environmental risks and the media," Routledge, 2013, pp. 217–233.

Appendix A. A CCI for each country.

United Kingdom We use the keywords "Climate Change" for The Guardian, The Times, The Sun, and The Independent.

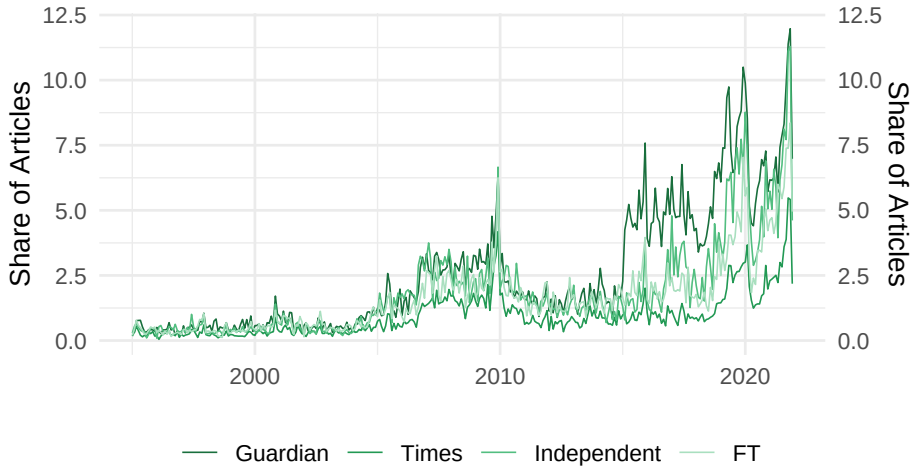

Figure 5: Share of Articles in the British Media

Spain We use the keywords "Cambio Climático (Climate Change)" for El Mundo, El País, and ABC.

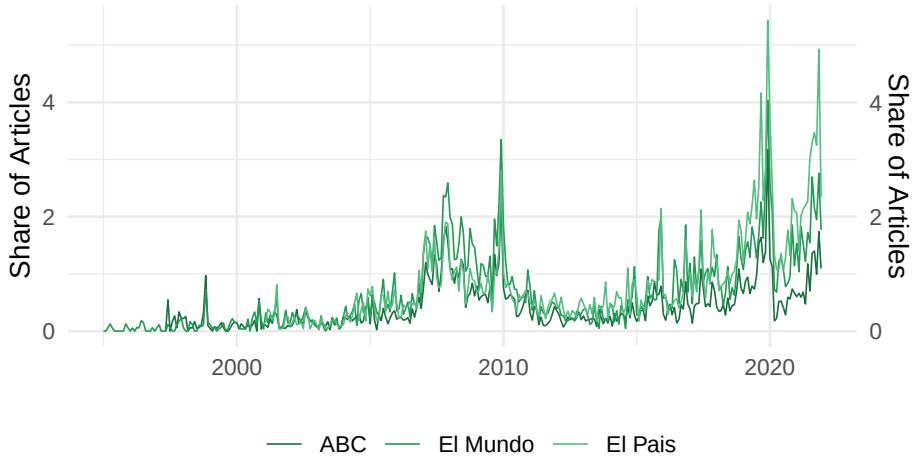

Figure 6: Share of Articles in the Spanish Media

Germany We use the keywords "Klimawandel (Climate Change)" and how much they have been used in Bild and DIE ZEIT.

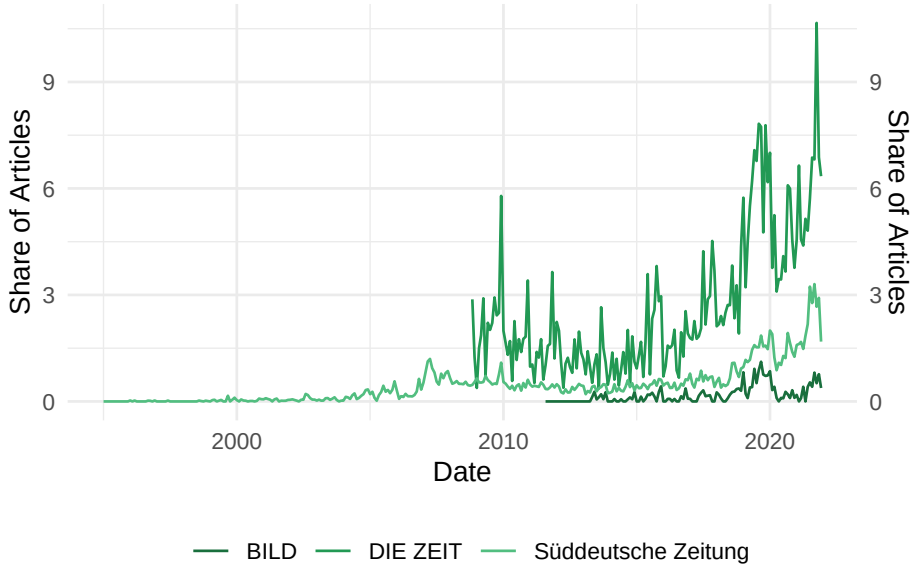

Figure 7: Share of Articles in the German Media

France We use the keywords "Changement Climatique (Climate Change)" and how much they have been used in Le Figaro and Les Echos

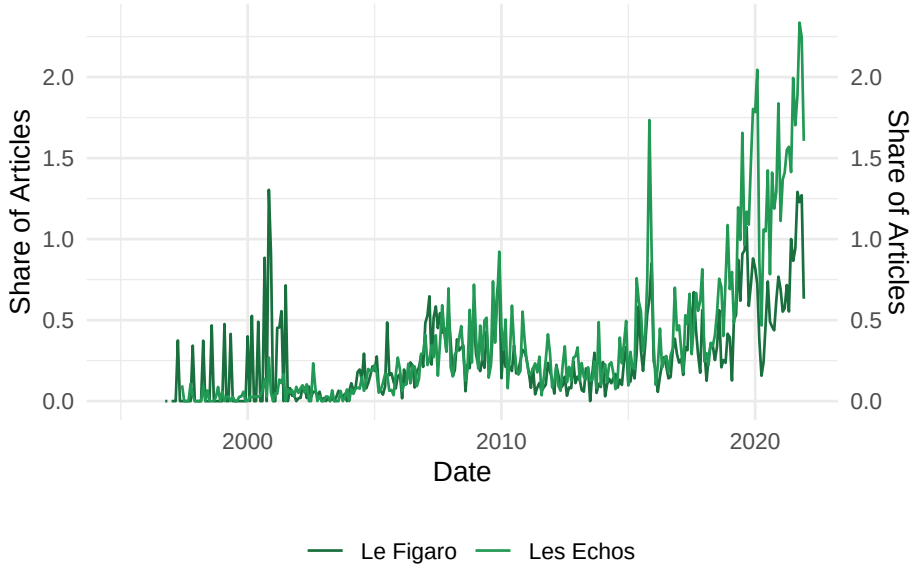

Figure 8: Share of Articles in the French Media

Italy We use the keywords "Cambiamento Climatico (Climate Change)" and how much they have been used in Corriere della Sera, and La Repubblica.

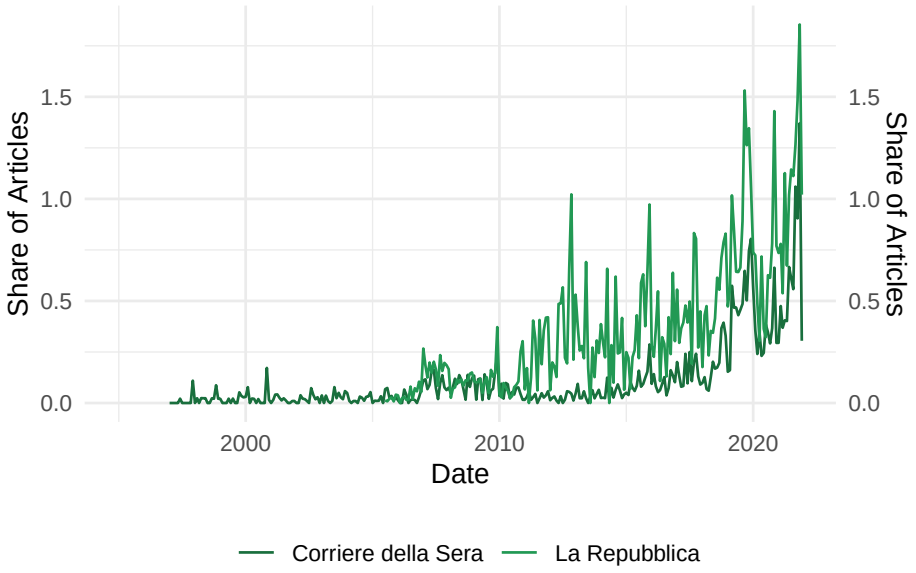

Figure 9: Share of Articles in the Italian Media

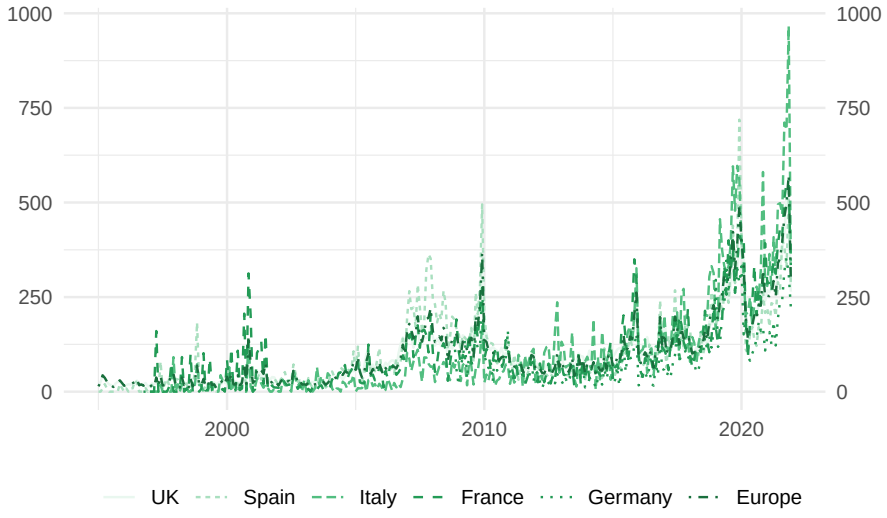

Figure 10: Climate Change Index for the European Countries

Appendix B. Natural Science Journals.

Science We count the number of articles (total) published in Science and Nature that use "Climate Change" in their abstract for the period 1995-2021.

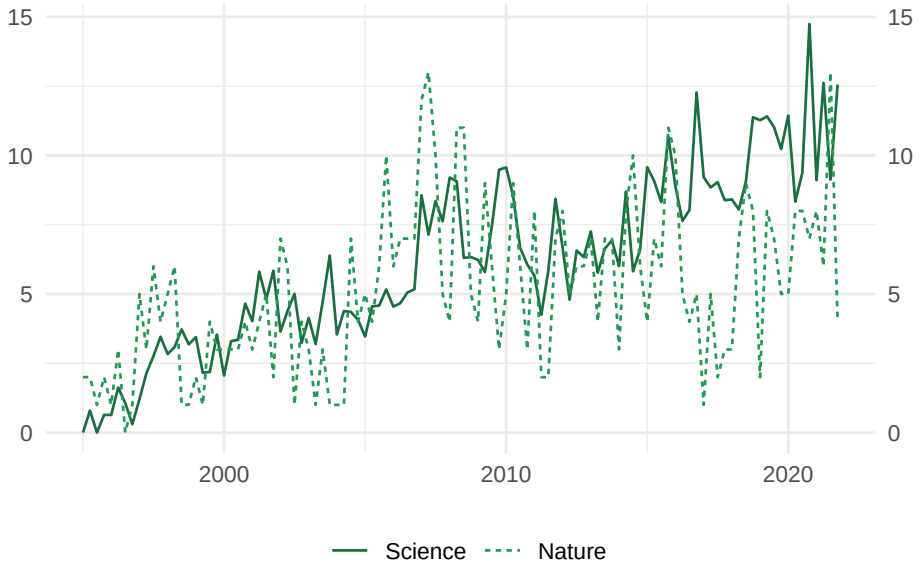

Figure 11: Quarterly Share of Articles in Science containing "Climate Change".

Appendix C

In the following table we show a comparison of mentions over time in ECB presidential speeches of climate change with taxex and inequality.

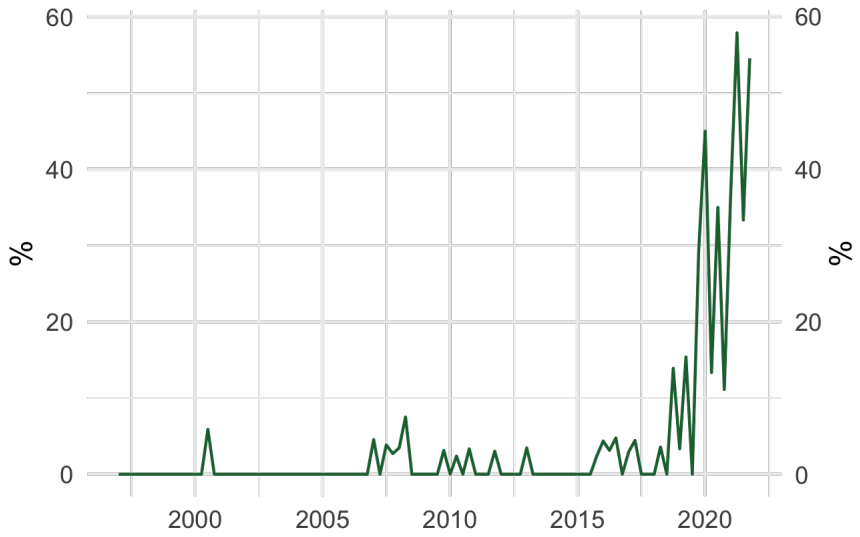

Figure 12: Share of Speeches from the ECB containing the words "Climate Change"

	date	n	climate change	global warming	tax	taxes	inequality
1	1997 Q1	2	0	0	2	0	0
2	1997 Q2	6	0	0	1	1	0
3	1997 Q3	2	0	0	0	0	0
4	1997 Q4	9	0	0	4	1	0
5	1998 Q1	7	0	0	2	1	0
6	1998 Q2	1	0	0	0	0	0
7	1998 Q3	8	0	0	1	1	0
8	1998 Q4	22	0	0	9	6	0
9	1999 Q1	20	0	0	8	4	0
10	1999 Q2	27	0	1	14	3	0
11	1999 Q3	18	0	0	7	3	0
12	1999 Q4	27	0	0	11	3	0
13	2000 Q1	14	0	0	7	2	0
14	2000 Q2	18	0	0	8	3	0
15	2000 Q3	17	1	0	8	2	0
16	2000 Q4	21	0	0	8	2	0
17	2001 Q1	14	0	0	9	2	1
18	2001 Q2	16	0	0	8	3	0
19	2001 Q3	13	0	0	3	0	0
20	2001 Q4	22	0	0	4	1	0
21	2002 Q1	20	0	1	9	4	0
22	2002 Q2	18	0	0	6	1	0
23	2002 Q3	8	0	0	3	2	0
24	2002 Q4	19	0	0	5	1	0
25	2003 Q1	12	0	0	5	3	0
26	2003 Q2	18	0	0	5	3	0
27	2003 Q3	10	0	0	2	0	0
28	2003 Q4	24	0	0	7	3	0
29	2004 Q1	16	0	0	9	6	0
30	2004 Q2	31	0	0	18	9	0

	date	n	climate change	global warming	tax	taxes	inequality
31	2004 Q3	14	0	0	6	6	0
32	2004 Q4	30	0	0	12	7	0
33	2005 Q1	13	0	0	7	2	0
34	2005 Q2	29	0	0	13	9	1
35	2005 Q3	13	0	0	5	4	0
36	2005 Q4	26	0	0	8	5	0
37	2006 Q1	20	0	0	12	5	0
38	2006 Q2	31	0	0	16	7	0
39	2006 Q3	16	0	0	9	5	0
40	2006 Q4	29	0	0	14	7	0
41	2007 Q1	22	1	0	7	3	1
42	2007 Q2	33	0	0	8	4	2
43	2007 Q3	26	1	0	6	3	0
44	2007 Q4	37	1	0	14	4	1
45	2008 Q1	29	1	0	7	6	0
46	2008 Q2	40	3	0	10	6	0
47	2008 Q3	29	0	0	11	4	1
48	2008 Q4	34	0	0	13	3	2
49	2009 Q1	26	0	0	7	1	0
50	2009 Q2	34	0	0	5	2	0
51	2009 Q3	20	0	0	6	1	0
52	2009 Q4	32	1	1	7	0	0
53	2010 Q1	22	0	0	7	2	0
54	2010 Q2	42	1	0	14	2	0
55	2010 Q3	24	0	0	10	4	1
56	2010 Q4	30	1	0	6	1	4
57	2011 Q1	28	0	0	11	3	1
58	2011 Q2	45	0	0	11	2	1
59	2011 Q3	13	0	0	5	0	1
60	2011 Q4	33	1	0	13	3	0

	date	n	climate change	global warming	tax	taxes	inequality
61	2012 Q1	11	0	0	5	0	0
62	2012 Q2	33	0	0	13	5	0
63	2012 Q3	17	0	0	6	1	0
64	2012 Q4	30	0	0	17	4	1
65	2013 Q1	29	1	0	12	5	0
66	2013 Q2	42	0	0	22	3	3
67	2013 Q3	25	0	0	10	1	1
68	2013 Q4	37	0	0	20	4	3
69	2014 Q1	20	0	0	6	3	1
70	2014 Q2	31	0	0	14	3	1
71	2014 Q3	23	0	0	10	3	0
72	2014 Q4	30	0	0	9	4	1
73	2015 Q1	20	0	0	6	1	1
74	2015 Q2	25	0	0	12	3	3
75	2015 Q3	17	0	0	5	0	1
76	2015 Q4	42	1	0	12	3	1
77	2016 Q1	23	1	0	9	5	0
78	2016 Q2	32	1	0	12	1	3
79	2016 Q3	21	1	0	10	1	1
80	2016 Q4	34	0	0	19	2	4
81	2017 Q1	34	1	0	9	1	2
82	2017 Q2	45	2	0	10	3	1
83	2017 Q3	30	0	0	6	1	4
84	2017 Q4	39	0	0	10	2	4
85	2018 Q1	29	0	0	8	1	2
86	2018 Q2	28	1	0	13	8	4
87	2018 Q3	20	0	0	5	0	1
88	2018 Q4	36	5	1	11	1	2
89	2019 Q1	30	1	0	9	1	3
90	2019 Q2	26	4	0	8	1	2

	date	n	climate change	global warming	tax	taxes	inequality
91	2019 Q3	17	0	0	4	0	1
92	2019 Q4	34	10	1	13	6	6
93	2020 Q1	20	9	1	8	2	3
94	2020 Q2	15	2	0	1	0	0
95	2020 Q3	20	7	2	6	0	3
96	2020 Q4	27	3	0	6	0	3
97	2021 Q1	19	7	0	4	2	1
98	2021 Q2	19	11	4	5	0	2
99	2021 Q3	12	4	1	4	1	3
100	2021 Q4	11	8	2	3	0	1

date	n	climate change	covid	price	taxes	inequality
1997-02-01	1	0	0	1	0	0
1997-03-01	1	0	0	1	0	0
1997-04-01	2	0	0	2	0	0
1997-05-01	1	0	0	1	0	0
1997-06-01	3	0	0	2	1	0
1997-09-01	2	0	0	2	0	0
1997-10-01	4	0	0	4	1	0
1997-11-01	5	0	0	5	0	0
1998-01-01	4	0	0	4	1	0
1998-02-01	2	0	0	2	0	0
1998-03-01	1	0	0	1	0	0
1998-06-01	1	0	0	1	0	0
1998-07-01	3	0	0	3	0	0
1998-09-01	5	0	0	4	1	0
1998-10-01	4	0	0	4	1	0
1998-11-01	9	0	0	9	2	0
1998-12-01	9	0	0	8	3	0
1999-01-01	6	0	0	6	0	0
1999-02-01	7	0	0	7	2	0
1999-03-01	7	0	0	7	2	0
1999-04-01	7	0	0	6	0	0
1999-05-01	10	0	0	10	2	0
1999-06-01	10	0	0	9	1	0
1999-07-01	5	0	0	5	1	0
1999-08-01	2	0	0	2	1	0
1999-09-01	11	0	0	11	1	0
1999-10-01	7	0	0	7	0	0
1999-11-01	16	0	0	14	3	0
1999-12-01	4	0	0	4	0	0

Table 5: ECB Speeches. 1997-2022

date	n	climate change	covid	price	taxes	inequality
2000-01-01	5	0	0	5	1	0
2000-02-01	4	0	0	3	0	0
2000-03-01	5	0	0	5	1	0
2000-04-01	4	0	0	3	0	0
2000-05-01	7	0	0	6	2	0
2000-06-01	7	0	0	6	1	0
2000-07-01	1	0	0	1	0	0
2000-08-01	1	0	0	1	0	0
2000-09-01	15	1	0	15	2	0
2000-10-01	6	0	0	6	0	0
2000-11-01	10	0	0	10	1	0
2000-12-01	5	0	0	4	1	0
2001-01-01	5	0	0	5	0	0
2001-02-01	6	0	0	6	1	0
2001-03-01	3	0	0	2	1	1
2001-04-01	2	0	0	1	0	0
2001-05-01	8	0	0	7	3	0
2001-06-01	6	0	0	6	0	0
2001-07-01	1	0	0	1	0	0
2001-08-01	4	0	0	2	0	0
2001-09-01	8	0	0	8	0	0
2001-10-01	8	0	0	8	0	0
2001-11-01	9	0	0	8	0	0
2001-12-01	5	0	0	5	1	0
2002-01-01	4	0	0	4	1	0
2002-02-01	7	0	0	7	2	0
2002-03-01	9	0	0	8	1	0
2002-04-01	7	0	0	6	0	0
2002-05-01	7	0	0	6	1	0
2002-06-01	4	0	0	2	0	0

Table 6: ECB Speeches. 1997-2022

date	n	climate change	covid	price	taxes	inequality
2002-07-01	5	0	0	4	1	0
2002-08-01	1	0	0	1	0	0
2002-09-01	2	0	0	1	1	0
2002-10-01	5	0	0	5	0	0
2002-11-01	8	0	0	7	0	0
2002-12-01	6	0	0	5	1	0
2003-01-01	1	0	0	1	0	0
2003-02-01	5	0	0	5	3	0
2003-03-01	6	0	0	5	0	0
2003-04-01	5	0	0	4	1	0
2003-05-01	4	0	0	4	0	0
2003-06-01	9	0	0	8	2	0
2003-07-01	5	0	0	5	0	0
2003-08-01	1	0	0	1	0	0
2003-09-01	4	0	0	4	0	0
2003-10-01	9	0	0	6	0	0
2003-11-01	12	0	0	10	2	0
2003-12-01	3	0	0	2	1	0
2004-01-01	6	0	0	4	3	0
2004-02-01	6	0	0	5	2	0
2004-03-01	4	0	0	4	1	0
2004-04-01	10	0	0	9	5	0
2004-05-01	13	0	0	12	3	0
2004-06-01	8	0	0	5	1	0
2004-07-01	3	0	0	3	3	0
2004-08-01	1	0	0	1	0	0
2004-09-01	10	0	0	8	3	0
2004-10-01	11	0	0	9	2	0
2004-11-01	10	0	0	8	3	0
2004-12-01	9	0	0	8	2	0

Table 7: ECB Speeches. 1997-2022

date	n	climate change	covid	price	taxes	inequality
2005-01-01	5	0	0	3	1	0
2005-02-01	2	0	0	1	0	0
2005-03-01	6	0	0	6	1	0
2005-04-01	7	0	0	6	2	0
2005-05-01	10	0	0	9	5	0
2005-06-01	12	0	0	12	2	1
2005-07-01	5	0	0	4	1	0
2005-08-01	2	0	0	1	0	0
2005-09-01	6	0	0	5	3	0
2005-10-01	12	0	0	9	2	0
2005-11-01	11	0	0	9	3	0
2005-12-01	3	0	0	3	0	0
2006-01-01	3	0	0	2	0	0
2006-02-01	8	0	0	6	4	0
2006-03-01	9	0	0	7	1	0
2006-04-01	6	0	0	6	1	0
2006-05-01	13	0	0	12	4	0
2006-06-01	12	0	0	11	2	0
2006-07-01	6	0	0	4	1	0
2006-09-01	10	0	0	8	4	0
2006-10-01	11	0	0	10	4	0
2006-11-01	12	0	0	11	1	0
2006-12-01	6	0	0	6	2	0
2007-01-01	8	0	0	7	1	1
2007-02-01	6	0	0	4	0	0
2007-03-01	8	1	0	6	2	0
2007-04-01	6	0	0	6	1	0
2007-05-01	12	0	0	9	0	2
2007-06-01	15	0	0	14	3	0

Table 8: ECB Speeches. 1997-2022

date	n	climate change	covid	price	taxes	inequality
2007-07-01	8	0	0	8	1	0
2007-08-01	1	0	0	1	1	0
2007-09-01	17	1	0	15	1	0
2007-10-01	14	0	0	14	2	0
2007-11-01	14	1	0	13	1	0
2007-12-01	9	0	0	8	1	1
2008-01-01	13	0	0	10	3	0
2008-02-01	9	1	0	7	1	0
2008-03-01	7	0	0	6	2	0
2008-04-01	18	0	0	17	3	0
2008-05-01	8	1	0	6	2	0
2008-06-01	14	2	0	14	1	0
2008-07-01	5	0	0	4	2	0
2008-08-01	1	0	0	1	0	0
2008-09-01	23	0	0	18	2	1
2008-10-01	9	0	0	8	1	1
2008-11-01	16	0	0	14	2	1
2008-12-01	9	0	0	9	0	0
2009-01-01	7	0	0	6	0	0
2009-02-01	10	0	0	7	1	0
2009-03-01	9	0	0	9	0	0
2009-04-01	7	0	0	6	0	0
2009-05-01	8	0	0	6	1	0
2009-06-01	19	0	0	17	1	0
2009-07-01	4	0	0	1	0	0
2009-08-01	1	0	0	1	0	0
2009-09-01	15	0	0	12	1	0
2009-10-01	9	0	0	8	0	0
2009-11-01	14	0	0	11	0	0
2009-12-01	9	1	0	6	0	0

Table 9: ECB Speeches. 1997-2022

date	n	climate change	covid	price	taxes	inequality
2010-01-01	5	0	0	4	0	0
2010-02-01	7	0	0	6	1	0
2010-03-01	10	0	0	7	1	0
2010-04-01	16	1	0	13	1	0
2010-05-01	12	0	0	9	0	0
2010-06-01	14	0	0	12	1	0
2010-07-01	6	0	0	5	2	0
2010-08-01	1	0	0	1	1	1
2010-09-01	17	0	0	10	1	0
2010-10-01	12	0	0	10	0	2
2010-11-01	14	0	0	12	1	1
2010-12-01	4	1	0	4	0	1
2011-01-01	6	0	0	6	0	0
2011-02-01	10	0	0	8	0	0
2011-03-01	12	0	0	7	3	1
2011-04-01	5	0	0	4	0	0
2011-05-01	20	0	0	17	1	1
2011-06-01	20	0	0	17	1	0
2011-07-01	3	0	0	0	0	0
2011-08-01	3	0	0	2	0	1
2011-09-01	7	0	0	5	0	0
2011-10-01	14	1	0	13	1	0
2011-11-01	12	0	0	10	0	0
2011-12-01	7	0	0	7	2	0
2012-02-01	4	0	0	4	0	0
2012-03-01	7	0	0	5	0	0
2012-04-01	12	0	0	11	4	0
2012-05-01	11	0	0	9	1	0
2012-06-01	10	0	0	8	0	0

Table 10: ECB Speeches. 1997-2022

date	n	climate change	covid	price	taxes	inequality
2012-07-01	7	0	0	2	1	0
2012-08-01	2	0	0	2	0	0
2012-09-01	8	0	0	7	0	0
2012-10-01	12	0	0	10	3	1
2012-11-01	11	0	0	9	1	0
2012-12-01	7	0	0	5	0	0
2013-01-01	9	0	0	7	1	0
2013-02-01	11	1	0	10	3	0
2013-03-01	9	0	0	4	1	0
2013-04-01	14	0	0	10	2	1
2013-05-01	13	0	0	9	1	0
2013-06-01	15	0	0	13	0	2
2013-07-01	9	0	0	5	1	0
2013-08-01	2	0	0	2	0	0
2013-09-01	14	0	0	12	0	1
2013-10-01	12	0	0	10	3	3
2013-11-01	17	0	0	11	0	0
2013-12-01	8	0	0	7	1	0
2014-01-01	7	0	0	4	1	0
2014-02-01	7	0	0	6	1	1
2014-03-01	6	0	0	5	1	0
2014-04-01	11	0	0	11	0	1
2014-05-01	14	0	0	12	1	0
2014-06-01	6	0	0	6	2	0
2014-07-01	9	0	0	8	1	0
2014-08-01	1	0	0	1	1	0
2014-09-01	13	0	0	9	1	0
2014-10-01	12	0	0	9	1	1
2014-11-01	15	0	0	11	2	0
2014-12-01	3	0	0	3	1	0

Table 11: ECB Speeches. 1997-2022

date	n	climate change	covid	price	taxes	inequality
2015-01-01	2	0	0	1	0	0
2015-02-01	6	0	0	4	0	0
2015-03-01	12	0	0	10	1	1
2015-04-01	9	0	0	8	1	0
2015-05-01	8	0	0	8	1	1
2015-06-01	8	0	0	5	1	2
2015-07-01	4	0	0	2	0	0
2015-08-01	3	0	0	3	0	1
2015-09-01	10	0	0	4	0	0
2015-10-01	16	1	0	10	0	0
2015-11-01	22	0	0	11	3	1
2015-12-01	4	0	0	3	0	0
2016-01-01	9	0	0	5	3	0
2016-02-01	8	1	0	8	0	0
2016-03-01	6	0	0	5	2	0
2016-04-01	11	0	0	9	1	1
2016-05-01	5	0	0	3	0	1
2016-06-01	16	1	0	10	0	1
2016-07-01	6	0	0	5	0	0
2016-08-01	2	0	0	2	0	0
2016-09-01	13	1	0	9	1	1
2016-10-01	14	0	0	13	0	2
2016-11-01	18	0	0	15	2	2
2016-12-01	2	0	0	1	0	0
2017-01-01	10	0	0	5	0	1
2017-02-01	9	1	0	9	1	1
2017-03-01	15	0	0	9	0	0
2017-04-01	15	0	0	9	1	1
2017-05-01	20	1	0	15	2	0
2017-06-01	10	1	0	6	0	0

Table 12: ECB Speeches. 1997-2022

date	n	climate change	covid	price	taxes	inequality
2017-07-01	8	0	0	7	0	0
2017-08-01	3	0	0	2	1	2
2017-09-01	19	0	0	12	0	2
2017-10-01	15	0	0	10	0	2
2017-11-01	22	0	0	15	1	2
2017-12-01	2	0	0	2	1	0
2018-01-01	4	0	0	3	1	0
2018-02-01	15	0	0	10	0	2
2018-03-01	10	0	0	6	0	0
2018-04-01	9	0	0	8	2	1
2018-05-01	14	1	0	13	6	3
2018-06-01	5	0	0	5	0	0
2018-07-01	7	0	0	4	0	1
2018-08-01	1	0	0	1	0	0
2018-09-01	12	0	0	10	0	0
2018-10-01	11	2	0	11	0	1
2018-11-01	20	3	0	13	1	1
2018-12-01	5	0	0	2	0	0
2019-01-01	8	1	0	4	0	0
2019-02-01	11	0	0	8	0	1
2019-03-01	11	0	0	9	1	2
2019-04-01	4	1	0	2	0	0
2019-05-01	13	2	0	7	1	2
2019-06-01	9	1	0	5	0	0
2019-07-01	5	0	0	5	0	0
2019-08-01	1	0	0	1	0	0
2019-09-01	11	0	0	6	0	1
2019-10-01	10	3	0	9	3	3
2019-11-01	18	4	0	12	2	2
2019-12-01	6	3	0	5	1	1

Table 13: ECB Speeches. 1997-2022

date	n	climate change	covid	price	taxes	inequality
2020-01-01	4	2	0	1	0	1
2020-02-01	15	7	0	14	2	2
2020-03-01	1	0	0	1	0	0
2020-04-01	2	0	2	2	0	0
2020-05-01	5	1	3	4	0	0
2020-06-01	8	1	7	8	0	0
2020-07-01	6	1	5	3	0	0
2020-08-01	2	1	2	2	0	0
2020-09-01	12	5	10	8	0	3
2020-10-01	9	1	5	4	0	1
2020-11-01	14	2	11	13	0	1
2020-12-01	4	0	4	1	0	1
2021-01-01	5	3	3	3	1	1
2021-02-01	5	2	4	4	1	0
2021-03-01	9	2	8	5	0	0
2021-04-01	6	3	5	5	0	1
2021-05-01	4	3	1	3	0	1
2021-06-01	9	5	6	5	0	0
2021-07-01	3	2	2	3	0	2
2021-08-01	1	0	1	1	0	0
2021-09-01	8	2	4	7	1	1
2021-10-01	11	8	6	8	0	1
2021-11-01	18	8	9	13	2	3
2021-12-01	4	2	4	4	0	1
2022-01-01	3	2	2	3	1	0
2022-02-01	11	3	3	8	0	1
2022-03-01	10	4	4	9	2	1
2022-04-01	10	6	4	10	2	1
2022-05-01	6	0	2	6	0	1
2022-06-01	9	2	2	6	0	0

Table 14: ECB Speeches. 1997-2022